PROJECT: MA12067B ID:

STATE	STATE PROJECT REFERENCE NO.		SHEET NO.	TOTAL SHEETS
N.C.	MA12067B		1	27
STATE PROJ. NO.	F.A. PROJ. NO.		DESCRIPTION	
			P.E.	
			CONST.	

STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

STRUCTURE SUBSURFACE INVESTIGATION

CONTENTS:

STATE PROJECT MA12067B I.D. NO. _____

F.A. PROJECT _____

COUNTY CATAWBA

PROJECT DESCRIPTION BRIDGE #25 OVER SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK

SITE DESCRIPTION _____

DRAWN BY: E. WAGNER

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N. C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IT IS CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

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THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

INVESTIGATED BY C. BRUINSMA PERSONNEL M. KORN

CHECKED BY M. ROBERTSON, L.G.

SUBMITTED BY TIERRA, INC.

DATE SEP., 2005

NORTH CAROLINA PROFESSIONAL SEAL 030675 ENGINEER SEUNGWOON HAN SEAL

10/11/05

SIGNATURE

ID	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
	MA12067B	2	27

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤35% PASSING #200)							SILT-CLAY MATERIALS (>35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10	50 MX													
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
LIQUID LIMIT	6 MX		N.P.	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PLASTIC INDEX				10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	No MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

P.I. OF A-7-5 ≤ L.L. - 30 ; P.I. OF A-7-6 > L.L. - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE	<4	N/A
	LOOSE	4 TO 10	
	MEDIUM DENSE	10 TO 30	
	DENSE	30 TO 50	
	VERY DENSE	>50	
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT	<2	<0.25
	SOFT	2 TO 4	0.25 TO 0.5
	MEDIUM STIFF	4 TO 8	0.5 TO 1
	STIFF	8 TO 15	1 TO 2
	VERY STIFF	15 TO 30	2 TO 4
	HARD	>30	>4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.0	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F. SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12"	3"				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE < (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
S — SHRINKAGE LIMIT		
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NONPLASTIC	0-5	VERY LOW
LOW PLASTICITY	5-15	SLIGHT
MED. PLASTICITY	16-25	MEDIUM
HIGH PLASTICITY	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE

UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)

GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LIQUID LIMIT LESS THAN 30
MODERATELY COMPRESSIBLE	LIQUID LIMIT 31-50
HIGHLY COMPRESSIBLE	LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT- CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	>10%	>20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING.
- STATIC WATER LEVEL AFTER 24 HOURS.
- PW — PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA
- SPRING OR SEEPAGE

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS
- INFERRED SOIL BOUNDARIES
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP/DIP DIRECTION OF ROCK STRUCTURES
- SOUNDING ROD
- SPT CPT DPT DMT VST PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- SPT N-VALUE
- REF — SPT REFUSAL

SAMPLE DESIGNATIONS

- S- BULK SAMPLE
- SS- SPLIT SPOON SAMPLE
- ST- SHELBY TUBE SAMPLE
- RS- ROCK SAMPLE
- RT- RECOMPACTED TRIAXIAL SAMPLE
- CBR - CBR SAMPLE

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
C.T. - CORING TERMINATED
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F. - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED
FRAGS. - FRAGMENTS
MED. - MEDIUM
PMT - PRESSUREMETER TEST
REF. - REFUSAL
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT
W - MOISTURE CONTENT
V. - VERY
VST - VANE SHEAR TEST

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- ☐ MOBILE B-___
- ☐ BK-51
- ☐ CME-45
- ☐ CME-550
- ☐ PORTABLE HOIST
- ☒ OTHER D-50
- ☐ OTHER _____

ADVANCING TOOLS:
- ☐ CLAY BITS
- ☐ 6" CONTINUOUS FLIGHT AUGER
- ☐ 8" HOLLOW AUGERS
- ☐ HARD FACED FINGER BITS
- ☐ TUNG.-CARBIDE INSERTS
- ☒ CASING ☐ W/ ADVANCER
- ☒ TRICONE 3 " STEEL TEETH
- ☐ TRICONE _____ " TUNG.-CARB.
- ☒ CORE BIT
- ☐ OTHER _____

HAMMER TYPE:
- ☒ AUTOMATIC ☐ MANUAL

CORE SIZE:
- ☐ -B_____
- ☐ -N_____
- ☒ -H Q

HAND TOOLS:
- ☐ POST HOLE DIGGER
- ☐ HAND AUGER
- ☐ SOUNDING ROD
- ☐ VANE SHEAR TEST
- ☐ OTHER _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.

ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT YIELDS SPT N VALUES > 100 BLOWS PER FOOT.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V. SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCKS EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, YIELDS SPT N VALUES > 100 BPF*
VERY SEVERE (V. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE CRIGINAL ROCK FABRIC REMAIN. *IF TESTED, YIELDS SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGISTS PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGISTS PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGISTS PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FEET
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	> 4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IS IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (F.P.) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, WHICH HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS LESS THAN 0.1 FOOT PENETRATION WITH 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (S.R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: BM #2, -L- STA. 21+56.69, 65.37' LT.

ELEVATION: 914.62'

NOTES:

October 11, 2005

Mr. Charles L. Flowe, P.E.
TGS Engineers
975 Walnut Street
Cary, NC 27511

Re: Geotechnical Subsurface Exploration Report
Project No.: MA12067B
County: Catawba County
Description: Bridge No. 25 on SR-1491 over Lyle Creek
Tierra Inc. Proj. No.: 6211-05-021

Dear Mr. Flowe:

As authorized, Tierra, Inc. has completed the geotechnical subsurface exploration for Bridge No. 25 on SR-1491 over Lyle Creek. Our investigation was performed in general accordance with our proposal number TR-04-119. The purpose of this report is to present subsurface conditions and foundation design recommendations for the planned structure. Field and laboratory test results, site and boring location plans, and profile/cross sections depicting subsurface conditions may be found in the appendix of this report.

PROJECT DESCRIPTION

According to the Bridge Survey and Hydraulic Design Report dated July 2005, the referenced project intends to replace the existing three span bridge, currently spanning Lyle Creek. The proposed replacement structure will be a two span, three bent bridge, approximately 90 feet long. The proposed bridge will be located between Station 12+04 and Station 12+94, with a skew angle of 120°. The bridge will be replaced along the same alignment with no grade changes.

SITE DESCRIPTION/GEOLOGY

The proposed project site is located along SR 1491 in a rural area of Catawba County, approximately 2 miles outside the city limits of Hickory, North Carolina. The area has generally level terrain with a relatively narrow flood plain. In general this area is residential in use. It is estimated that the Lyle Creek floodplain is approximately 200 feet wide at the bridge site. Lyle Creek flows in an easterly direction into the Catawba River approximately 11 miles downstream. Depth of water at the time of drilling was approximately one foot.

According to ***The Geologic Map of North Carolina*** (1985), the project site is part of the Piedmont Physiographic Providence and is located in the Inner Piedmont Belt. In general, the site consists of metamorphosed amphibolite and biotite gneiss (Czab). These rocks are typically hornblende gneiss interlayered with metagabbro, mica schist and granitic rock and are generally Proterozoic in age. Rocks encountered consist of a majority of hornblende gneiss with garnets and occasional equigranular massive amphibolite.

2736 Rowland Road ▪ Raleigh, North Carolina 27615
Phone (919) 871-0800 ▪ Fax (919) 871-0803

FIELD EVALUATION PROCEDURE

The subsurface exploration consisted of performing (5) soil test borings near the centerlines of the proposed end bents and interior bent. Borings were performed with a Diedrich D50 track mounted drill rig with an automatic hammer. Standard Penetration Tests (SPT) and soil sampling were performed in general accordance with American Association of State Highway Transportation Officials (AASHTO T-206-87), and North Carolina Department of Transportation (NCDOT) latest Geotechnical Guidelines and Procedures Manual.

Groundwater measurement readings were taken within each borehole with a weighted 100-foot measuring tape from a survey reference location at the top of each boring. Readings were recorded immediately after boring termination and after a 24-hour waiting period. Surveyed borehole elevations at the site were based on a benchmark (BM#2) at Station 21+56.69, 65.37 feet left of (-L-), with an elevation of 914.62 feet Mean Sea Level (MSL) (NAVD 1988).

In addition to our subsurface investigation, a visual scour evaluation was performed along the channel and banks of Lyle Creek to determine scour impact for foundation design purposes. The scour report is included in the appendix of this report.

SUBSURFACE AND GROUNDWATER CONDITIONS

Subsurface soils penetrated beneath the site consist of roadway embankment, alluvium deposits and residual materials. Weathered and crystalline rocks were penetrated beneath subsurface soils.

End Bents

Soils beneath End Bent 1 consist of roadway embankment, alluvial deposits and residual materials. Roadway embankment consists of an average 9 feet of medium stiff to soft sandy clay (A-6). Alluvium soils consist of average of 12.5 feet of soft to medium stiff sandy silt (A-4) and loose silty sand (A-2-4). Residual soils consist of approximately 10 feet of very loose to dense silty sand (A-2-4). Weathered gneiss was penetrated at varying elevations of 883 feet and 879 feet (MSL). Crystalline rock was penetrated beneath weathered gneiss.

Soils beneath End Bent 2 consist of roadway embankment, alluvial deposits and residual materials. Roadway embankment consists of 8 feet of stiff to soft sandy clay (A-7-5). Alluvium soils were encountered beneath EB2B and consist of 5.5 feet of soft sandy clayey silt (A-4). Residual soils consist of an average of 19 feet of medium stiff sandy silt (A-4) and loose to dense silty sand (A-2-4). Weathered gneiss was encountered at varying elevations of 884 feet and 876 feet (MSL).

Interior Bent

Soils beneath Interior Bent 1 consist of alluvium deposits and residual materials. Alluvium deposits consist of 11 feet of loose to very loose silty sand (A-2-4) and soft sandy silt (A-4). Residual materials consist of medium dense to very dense silty sand (A-2-4). Zones of weathered and crystalline rock are encountered between residual layers. Residual materials directly overlie crystalline gneiss at an approximate elevation of 874 feet (MSL).

Ground water across the site ranges in elevation between 900 and 890 feet (MSL). Water elevation at the time of our investigation was approximately 898 feet in Lyle Creek (MSL).

LABORATORY TESTING

Representative split-spoon samples were selected from soil test borings to verify visual field classification and determine soil index properties. A total of twelve samples were analyzed in our laboratory for natural moisture determination, Atterberg limits, and grain size analysis. Representative channel and bank samples were analyzed for grain size distribution. Two rock core samples were tested for compressive strength testing. All testing was performed in accordance with the following American Society for Testing and Materials (ASTM), (NCDOT) Modified and/or (AASHTO) procedures:

- AASHTO T-88-00 (As Modified) "Particle Size Analysis of Soil"
- AASHTO T-89-902(As Modified) "Determining the Liquid Limits of Soil"
- AASHTO T-90-00 "Determining the Plastic Limit and Plasticity of Soils"
- AASHTO T-265-93 "Laboratory Determination of Moisture Content of Soils"
- ASTM D 2938-95 "Unconfined Compressive Strength of Intact Rock Core"
- ASTM D 3148-02 "Elastic Moduli of Intact Rock Core in Uniaxial Compression"

CONCLUSIONS

Based on our subsurface investigation, soils consist of roadway embankment, alluvium deposits and residual soils. Weathered and crystalline gneiss exist approximately 30 feet beneath existing end bents and 13 feet beneath the proposed interior bent. Based on the consistencies and relative densities of the subsurface soils, the proposed bridge will be supported on a combination of driven piles and drilled piers bearing on weathered and or crystalline rock. Ground water should not impact construction.

FOUNDATION RECOMMENDATIONS

Based on the depth to competent bearing material the end bents of the bridge will be supported by driven HP 12x53 piles. The interior bent of the bridge will be supported by 42-inch concrete drilled piers. The piles will develop ultimate capacity with a safety factor of 2 from end bearing on weathered rock. The piers will develop ultimate capacity with a safety factor of 2.5 from side

skin friction and tip bearing on crystalline rock. For more information, refer to the attached "Summary of Foundation Recommendations".

According to the NCDOT Hydraulics Report, there are no grade changes; therefore, there are no anticipated embankment settlements at the bridge approaches. The end bent slopes are proposed to be 1.5 Horizontal: 1 Vertical (1.5H: 1V). Based upon our experience, slope stability will not be a concern if slopes are configured at (1.5H: 1V), with rip rap slope protection.

CLOSURE

Recommendations and evaluations provided by Tierra, Inc. are based on the Bridge Survey & Hydraulic Design Report dated July 2005. Modifications of our recommendations and evaluations may be required if there are changes to the design or location of the structure. Recommendations in this report are based on data obtained from soil borings. The nature and extent of variations between borings may not become evident until construction.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made. Tierra, Inc. appreciates this opportunity to have provided you with geotechnical engineering services for this project. If you have any questions regarding this report, please contact our office.

Sincerely,
TIERRA, INC.

Matthew A. Korn, EI
Staff Professional

10/11/05

NORTH CAROLINA PROFESSIONAL SEAL 030675 ENGINEER SEUNGWOON HAN

Seungwoon Han, Ph.D., P.E.
Geotechnical Engineer

SUMMARY OF FOUNDATION RECOMMENDATIONS

NCDOT PROJ. NO.: MA12067B **PROJECT DESCRIPTION:** Bridge # 25 on SR 1491 over Lyle Creek

T.I.P. NO.:

COUNTY: Catawba

STATION: 20+49 -L-

PREPARED BY: MAK **DATE:** 10/7/05

CHECKER: SWH **DATE:** 10/7/05

SEAL
NORTH CAROLINA PROFESSIONAL SEAL 030675 ENGINEER SEUNGWOON HAN
10/11/05
SIGNATURE

	STATION	FOUNDATION TYPE	ALLOWABLE LOAD	FOUNDATION DETAILS
END BENT 1	20+04 -L-	Cap on HP 12x53 Steel Pile	45 tons/Pile	Assumed Bottom of Cap = 908 ft ± Recommended Length of Pile = 30 ft
BENT 1	20+39 -L-	42" Drilled Pier	280 tons/Pier	Assumed Bottom of Cap = 909 ft ± Assumed Top of Pier = 901 ft Tip Elevation No Higher Than = 873 ft Recommended Length of Pier = 28 ft
END BENT 2	20+94 -L-	Cap on HP 12x53 Steel Pile	45 tons/Pile	Assumed Bottom of Cap = 908 ft ± Recommended Length of Pile = 35 ft

COMMENTS & NOTES (Attached)

Note on Plans:

1. Piles for End Bents No. 1 and 2 shall be driven to a minimum bearing capacity of 45 tons each.
2. When driving piles, the maximum blow counts shall not be exceeded.
3. The drilled piers at Bent No. 1 have been designed for both skin friction and tip bearing. The required tip bearing capacity is 30 TSF.
4. The required tip bearing capacity at Bent No. 1 shall be verified.
5. The drilled piers for Bent No. 1 have been designed for an applied load of 275 tons each at the top of the column.
6. Permanent steel casing may be required for drilled piers at Bent No.1. If required, the casing shall not extend below elevation 882 ft. without the engineer's permission. The need for permanent steel casing will be determined by the engineer.
7. For permanent steel casing, see special provision for drilled piers.
8. Drilled piers at Bent No. 1 shall extend to an elevation no higher than 873 ft. and satisfy the required tip bearing capacity.
9. The scour critical elevation for Bent No. 1 is 880 ft. The scour critical elevations are for use by maintenance forces to monitor possible scour problems during the life of the structure.
10. For drilled piers, see special provisions.
11. SPT testing is not required to determine the tip bearing capacity of the drilled piers at Bent No.1.
12. Slurry construction shall not be used for this project.
13. SID inspections are not required to determine the bottom cleanliness of the drilled piers at Bent No.1.

Comments:

1. 1.5 :1 (H:V) slope is Ok with Class II Rip Rap slope protection.
2. The elevation of the point of fixity for Bent No. 1 is 879 ft.
3. Design scour elevation for Bent No. 1 is 882 ft.

DRILLED PIER PAY ITEM QUANTITIES

PROJECT NO. MA12067B DATE 10/2/2005

TIP NO. _____ DESIGNED BY MAK

COUNTY Catawba CHECKED BY SWH

STATION 20+49 -L-

DESCRIPTION Bridge # 25 on SR 1491 over Lyle Creek

NUMBER OF BENTS WITH DRILLED PIERS 1

NUMBER OF PIERS PER BENT 3

	DRILLED PIER PAY ITEMS					
BENT #	PERMANENT STEEL CASING FOR 42 inch DIA. DRILLED PIER (yes/no/maybe)	42 inch DIA. DRILLED PIERS NOT IN SOIL (feet)	SPT TESTING (each)	SID INSPECTION (each)	CROSSHOLE SONIC LOGGING* (each)	CSL TUBES* (yes/no)
1	maybe	24	0	0	0	No
2						
3						
4						
5						
6						
7						
8						
9						
10						
TOTALS		24	0	0	0	

* Pay items, "Crosshole Sonic Logging" and "CSL Tubes" are not required unless CSL testing is required with a Note on Plans.

Notes:

Blanks or no represent quantity of zero.

If permanent steel casing is required or may be required, Structure Design should calculate the pay item quantity, "Permanent Steel Casing for ___ Dia. Drilled Pier", as the difference between the top of drilled pier elevation or the top of permanent steel casing elevation (whichever is lower) and the elevation the permanent steel casing can not extend below as shown with a Note on Plans.

Structure Design should determine the pay item quantity, "___ Dia. Drilled Piers in Soil", based upon the total drilled pier length per bent minus the "___ Dia. Drilled Piers not in Soil" per bent shown in the table above.

If CSL tubes are required, Structure design should calculate the pay item quantity, "CSL Tubes", as follows:
"CSL Tubes" per bent = (drilled pier length + 2.5 feet) x number of CSL tubes per pier
The number of CSL tubes per pier is dependent upon the drilled pier diameter. For drilled piers with a diameter of 5 feet or less, use 4 tubes. For drilled piers with a diameter greater than 5 feet, use 6 tubes.

DeLORME

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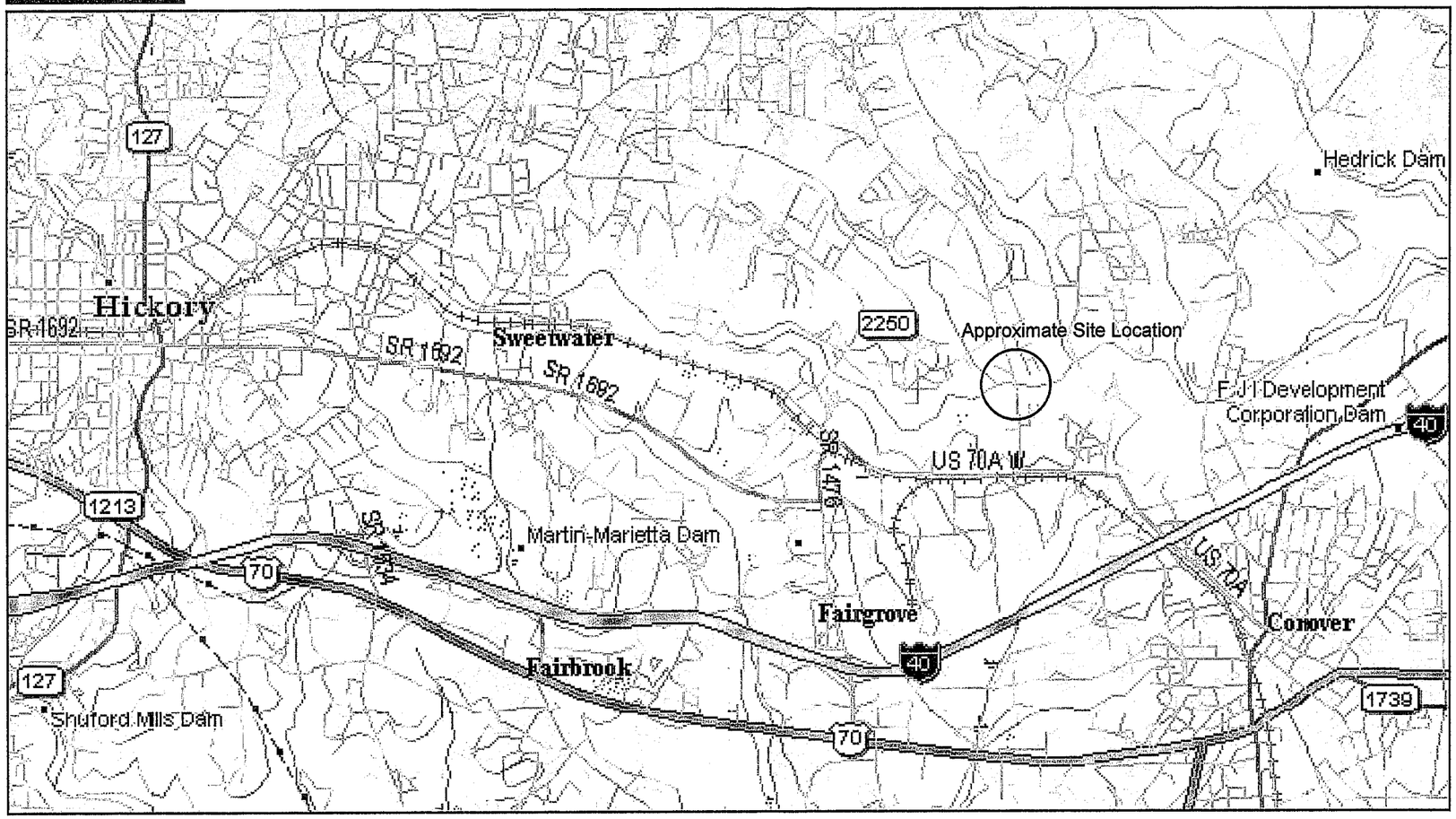

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MN (6.8° W)

0 ½ 1 1½ 2 mi

Data Zoom 11-0

SITE VICINITY MAP

BRIDGE NO. 25 ON SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA COUNTY, NORTH CAROLINA
STATE PROJECT: MA12067B

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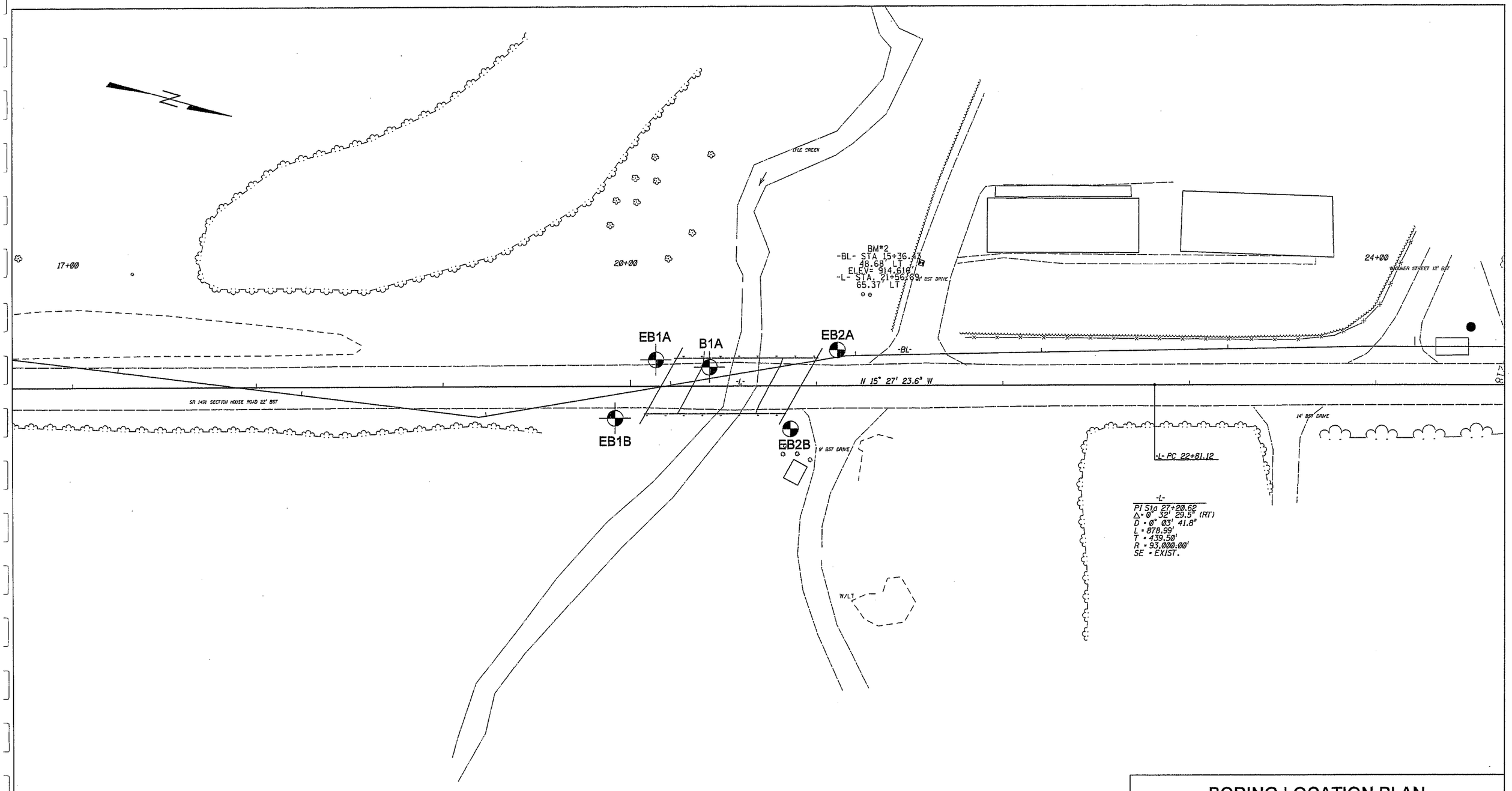

NOTES

BENCH MARK: BM #2, -L- STA. 21+56.69, 65.37' LT., ELEVATION 914.62'

PLANS ADOPTED FROM FILES PROVIDED BY TGS ENGINEERS

PROPOSED BRIDGE SKEW: 120°

0 50 100

FEET

BORING LOCATION PLAN

BRIDGE NO. 25 ON SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA COUNTY, NORTH CAROLINA
STATE PROJECT: MA12067B

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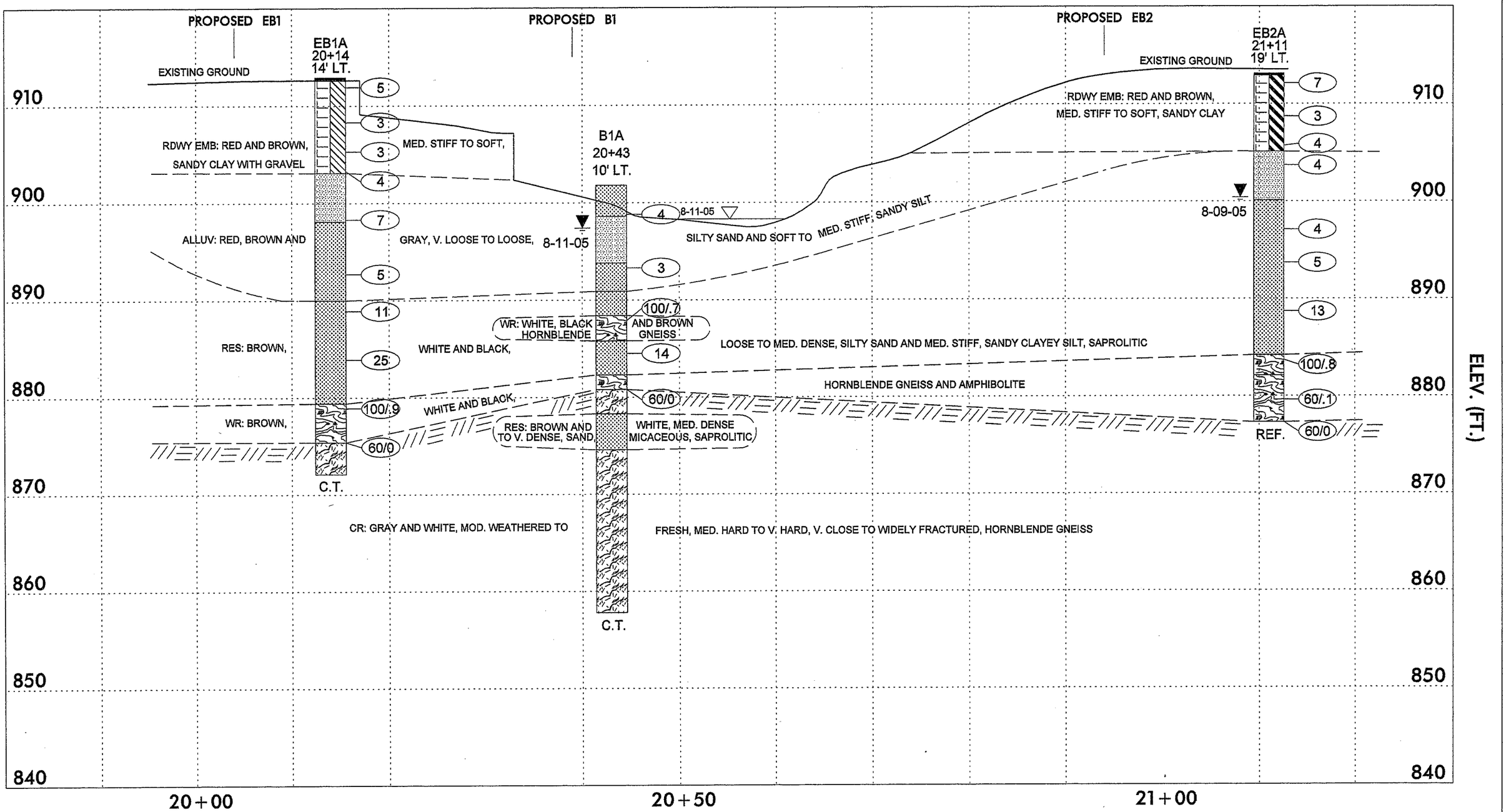

BENCH MARK: –L– STA. 21+56.69, 65.37' LEFT,
ELEVATION 914.62'

VERTICAL SCALE
0 10 20

HORIZONTAL SCALE
0 10 20

PROFILE 15' LEFT OF –L–

NCDOT PROJECT #: MA12067B
CATAWBA CO., NC
BRIDGE #25 ON SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK

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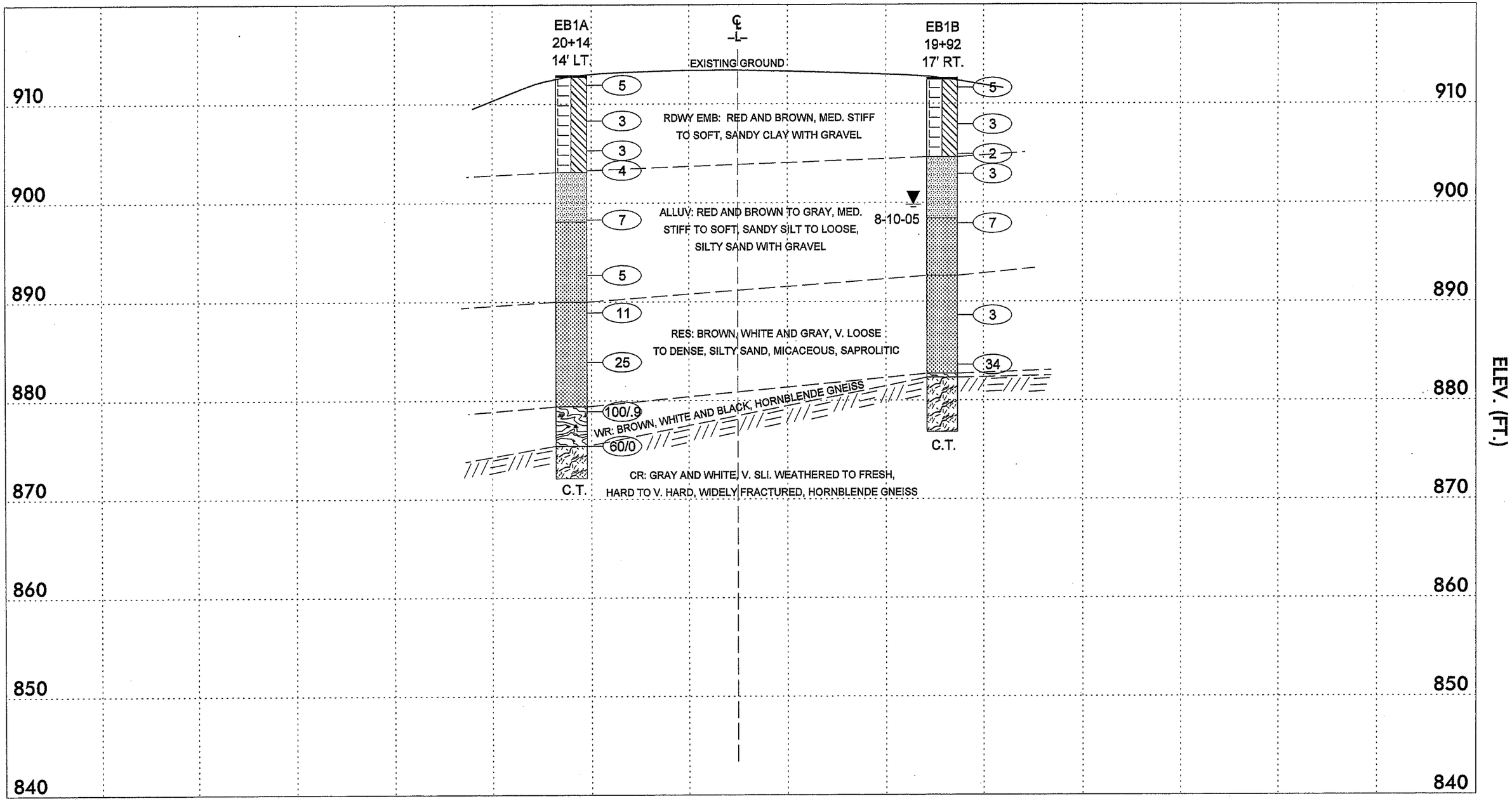

BENCH MARK: –L– STA. 21+56.69, 65.37' LEFT,
ELEVATION 914.62'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

CROSS SECTION END BENT 1

NCDOT PROJECT #: MA12067B
CATAWBA CO., NC
BRIDGE #25 ON SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK

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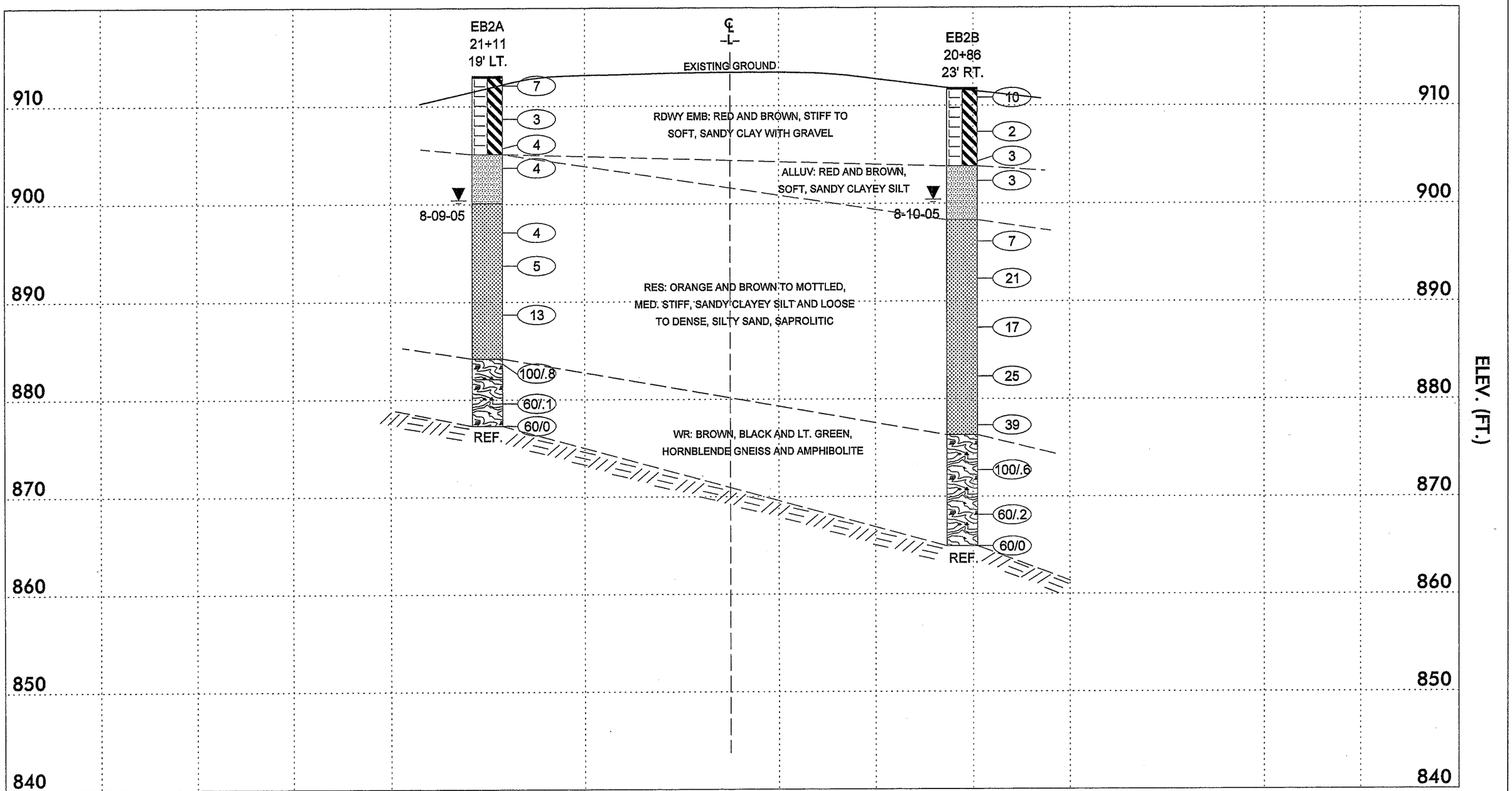

BENCH MARK: –L– STA. 21+56.69, 65.37' LEFT,
ELEVATION 914.62'

VERTICAL SCALE

0 10 20

HORIZONTAL SCALE

0 10 20

CROSS SECTION END BENT 2

NCDOT PROJECT #: MA12067B
CATAWBA CO., NC
BRIDGE #25 ON SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK

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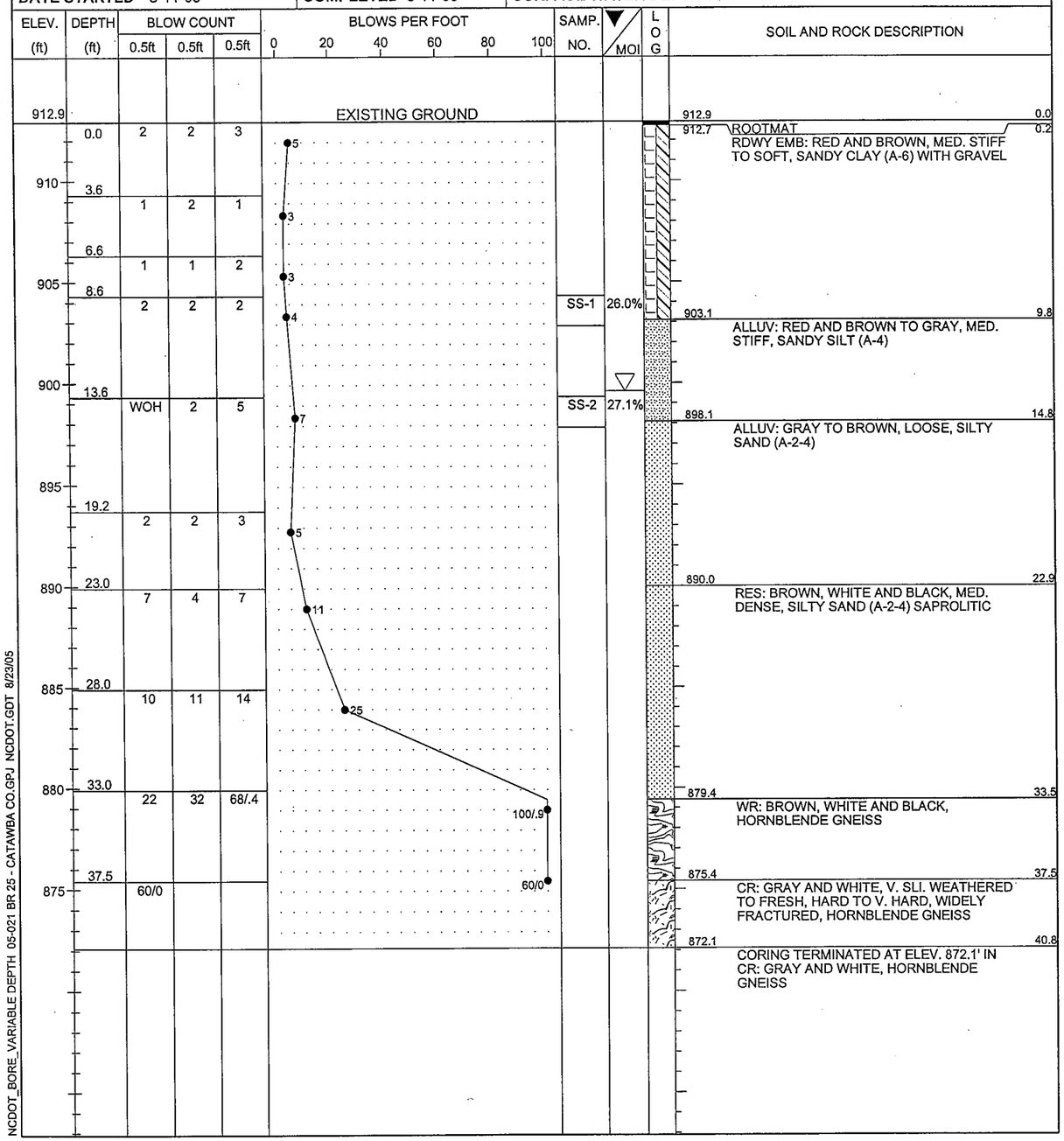
N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. MA12067B	**ID.**	**COUNTY** CATAWBA	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK			**GROUND WATER (ft)**
BORING NO. EB1A	**BORING LOCATION** 20+14	**OFFSET** 14' LT.	**ALIGNMENT** -L-	**0 HR.** 13.3
COLLAR ELEV. 912.9 ft	**NORTHING** 727,147.3	**EASTING** 1,333,800.8	**24 HR.** BACKFILL
TOTAL DEPTH 40.8 ft	**DRILL MACHINE** DIEDRICH 50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-11-05	**COMPLETED** 8-11-05	**SURFACE WATER DEPTH** N/A	



NCDOT_BORE_VARIABLE DEPTH 05-021 BR 25 - CATAWBA CO.GPJ NCDOT.GDT 8/23/05

12

CORE BORING REPORT

DATE: 8/11/05

PROJECT: MA12067B I.D. NO.: BORING NO: EB1A GEOLOGIST: C. BRUINSMA

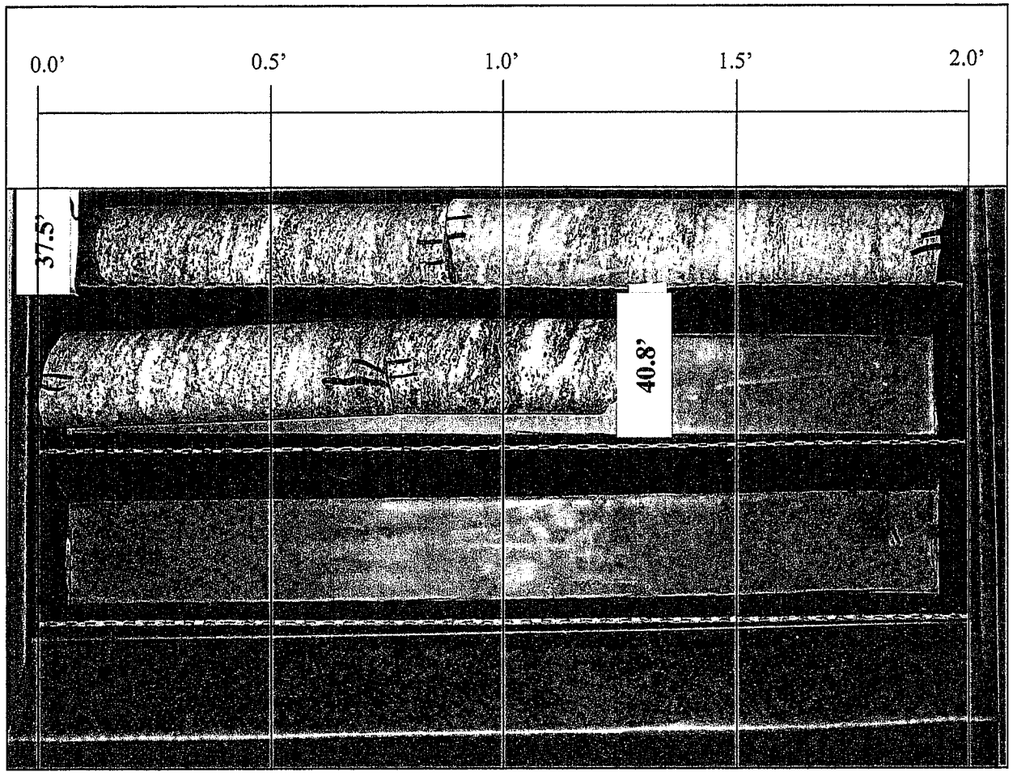
DESCRIPTION: BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK

COUNTY: CATAWBA COLLAR ELEV.: 912.9 FT TOTAL DEPTH: 40.8 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
875.4	37.5	7:30					37.5-40.8 CR: GRAY AND WHITE, V. SLI. WEATHERED TO FRESH, HARD TO V. HARD, WIDELY FRACTURED, HORNBLENDE GNEISS
		7:00		3.3/3.3	3.3/3.3		
		6:00	3.3				
		3:00/0.3		100%	100%		
872.1	40.8						STRATA REC = 100% STRATA RQD = 100%

CORING TERMINATED AT 40.8 FT
ELEVATION 872.1 FT

DRILLER: F. COX CORE SIZE: HQ EQUIPMENT: DIEDRICH 50



Boring EB1A, Box 1 of 1, 37.5 feet to 40.8 feet.

ROCK CORE PHOTOGRAPHS

BRIDGE NO. 25 OVER SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA COUNTY, NORTH CAROLINA
STATE PROJECT NO: MA12067B

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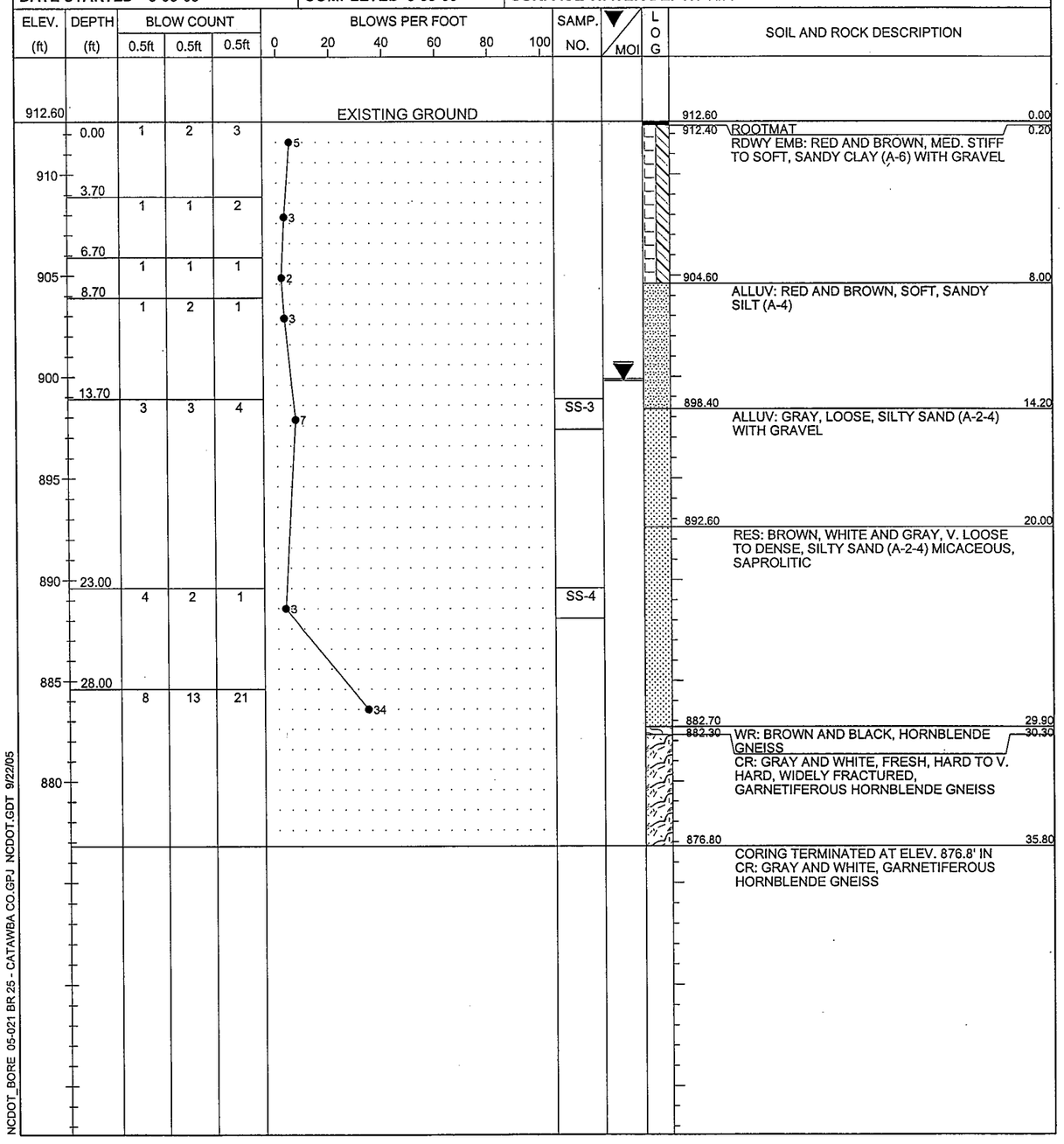
N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. MA12067B	**ID.**	**COUNTY** CATAWBA	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK			**GROUND WATER (ft)**
BORING NO. EB1B	**BORING LOCATION** 19+92	**OFFSET** 17' RT.	**ALIGNMENT** -L-	**0 HR.** 12.7
COLLAR ELEV. 912.6 ft	**NORTHING** 727,134.4	**EASTING** 1,333,836.6		**24 HR.** 12.8
TOTAL DEPTH 35.8 ft	**DRILL MACHINE** DIEDRICH 50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO	
DATE STARTED 8-09-05	**COMPLETED** 8-09-05	**SURFACE WATER DEPTH** N/A		



NCDOT_BORE 05-021 BR 25 - CATAWBA CO.GPJ NCDOT.GDT 9/22/05

CORE BORING REPORT

DATE: 8/09/05

PROJECT: MA12067B I.D. NO.: BORING NO: EB1B GEOLOGIST: C. BRUINSMA

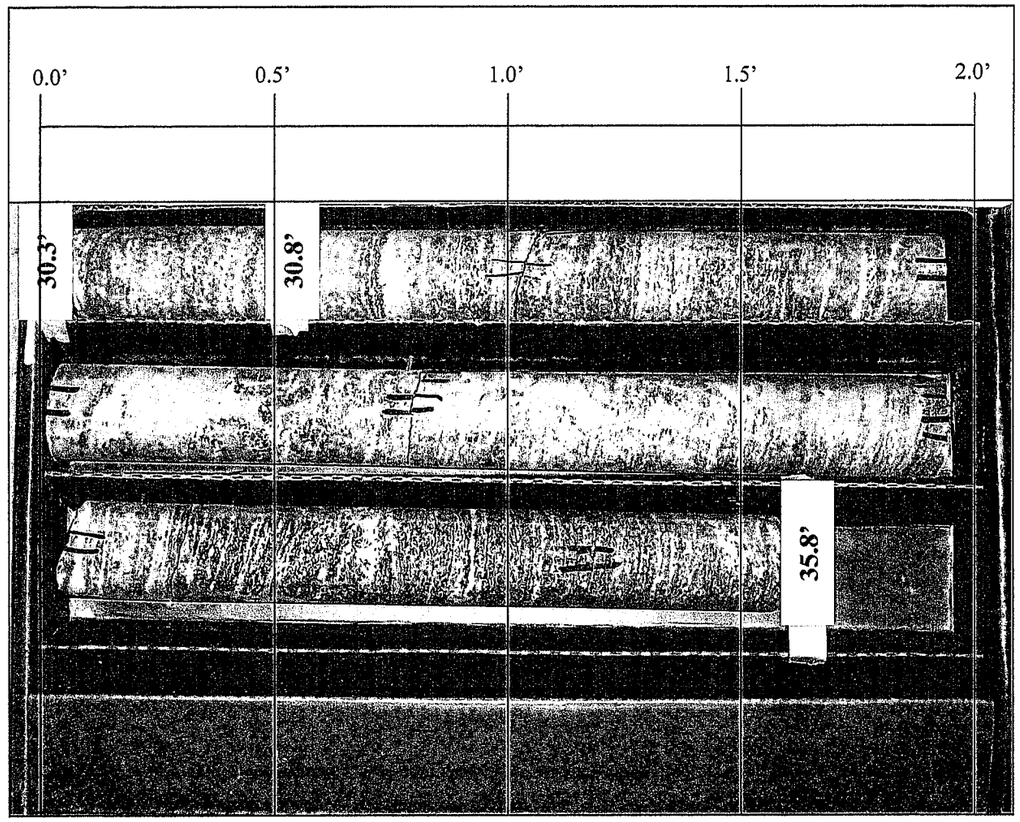
DESCRIPTION: BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK

COUNTY: CATAWBA COLLAR ELEV.: 912.6 FT TOTAL DEPTH: 35.8 FT

ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
882.3	30.3	3:00/0.6	0.5	0.5/0.5 100%	0.5/0.5 100%		30.3-35.8 CR: GRAY AND WHITE, FRESH, HARD TO V. HARD, WIDELY FRACTURED, GARNETIFEROUS HORNBLENDE GNEISS
881.8	30.8						
881.8	30.8	6:00	5.0	4.8/5.0 96%	4.8/5.0 96%		
876.8	35.8	6:00					STRATA REC = 96.4% STRATA RQD = 96.4%

CORING TERMINATED AT 35.8 FT
ELEVATION 876.8 FT

DRILLER: F. COX CORE SIZE: HQ EQUIPMENT: DIEDRICH 50



Boring EB1B, Box 1 of 1, 30.3 feet to 35.8 feet.

ROCK CORE PHOTOGRAPHS

BRIDGE NO. 25 OVER SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA COUNTY, NORTH CAROLINA
STATE PROJECT NO: MA12067B

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

PROJECT NO. MA12067B	ID.	COUNTY CATAWBA	GEOLOGIST C. BRUINSMA
SITE DESCRIPTION BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK			GROUND WATER (ft)
BORING NO. B1A	BORING LOCATION 20+43	OFFSET 10' LT.	ALIGNMENT -L-	0 HR. 4.2
COLLAR ELEV. 901.8 ft	NORTHING 727,176.3	EASTING 1,333,797.0	24 HR. 4.4
TOTAL DEPTH 44.0 ft	DRILL MACHINE DIEDRICH 50	DRILL METHOD MUD ROTARY	HAMMER TYPE AUTO
DATE STARTED 8-10-05	COMPLETED 8-10-05	SURFACE WATER DEPTH N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
901.8					EXISTING GROUND				901.8 0.0 ALLUV: BROWN, LOOSE, SILTY SAND (A-2-4)
900	2.0	3	2	2	4				898.6 3.2 ALLUV: GRAY AND BROWN, SOFT, SANDY SILT (A-4)
895	7.5	2	2	1	3	SS-5			893.8 8.0 ALLUV: GRAY AND BROWN, V. LOOSE, SILTY SAND (A-2-4)
890	12.9	22	64	36/.2	100/.7				890.9 10.9 RES: BROWN, WHITE AND BLACK, DENSE, SILTY SAND (A-2-4) SAPROLITIC
885	16.3	9	8	6	14				888.4 13.4 WR: WHITE, BLACK AND BROWN, HORNBLENDE GNEISS
880	21.0	60/0			60/0	RS-1			885.8 16.0 RES: WHITE, BLACK AND BROWN, MED. DENSE, SILTY SAND (A-2-4) MICACEOUS, SAPROLITIC
875									882.3 19.5 WR: WHITE, BLACK AND BROWN, HORNBLENDE GNEISS
870						RS-2			880.8 21.0 CR: GRAY, WHITE AND BLACK, V. SLI. TO MOD. SEV. WEATHERED, HARD TO MOD. HARD, V. CLOSE TO MOD. CLOSELY FRACTURED, HORNBLENDE GNEISS
865									878.3 23.5 RES: BROWN AND WHITE, MED. DENSE TO V. DENSE, SAND (A-2-4) WITH WR LAYERS, MICACEOUS, SAPROLITIC
860									874.6 27.2 CR: WHITE AND GRAY, MOD. WEATHERED TO FRESH, MED. HARD TO V. HARD, V. CLOSE TO WIDELY FRACTURED, HORNBLENDE GNEISS
									857.8 44.0 CORING TERMINATED AT ELEV. 857.8' IN CR: WHITE AND GRAY, HORNBLENDE GNEISS

NCDOT_BORE_VARIABLE DEPTH 05-021 BR 25 - CATAWBA CO.GPJ NCDOT.GDT 8/23/05

CORE BORING REPORT

DATE: 8/10/05

PROJECT: MA12067B I.D. NO.: BORING NO: B1A GEOLOGIST: C. BRUINSMA

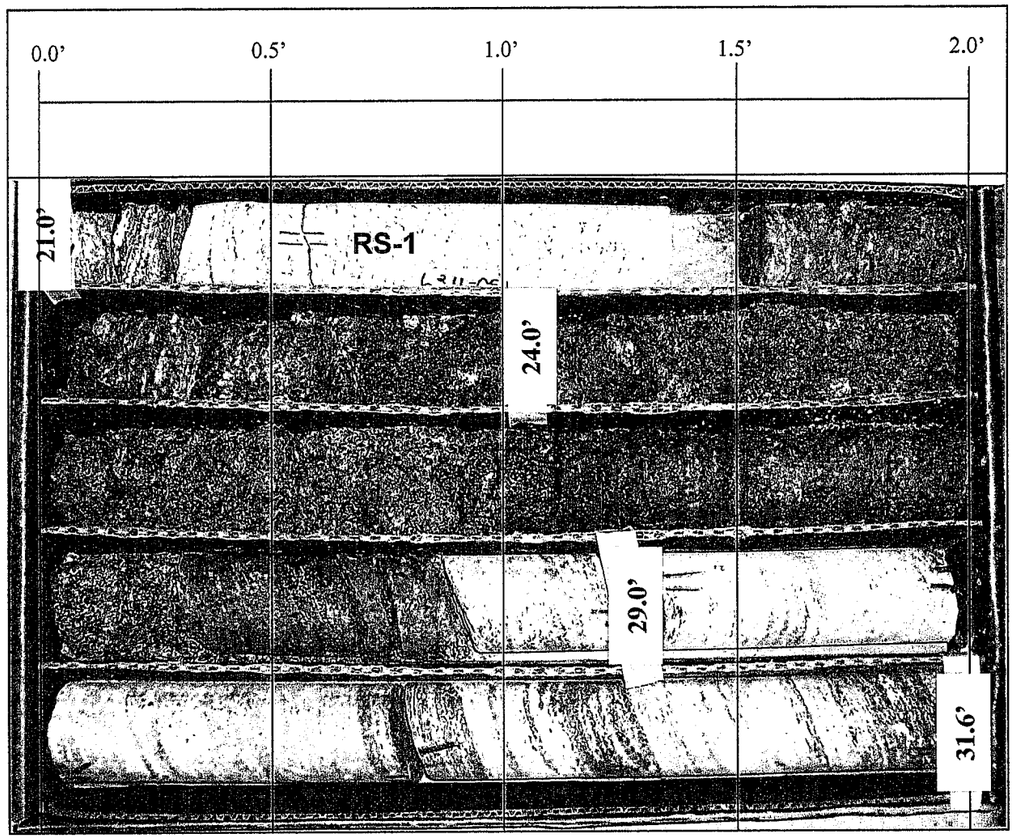
DESCRIPTION: BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK

COUNTY: CATAWBA COLLAR ELEV.: 901.8 FT TOTAL DEPTH: 44.0 FT

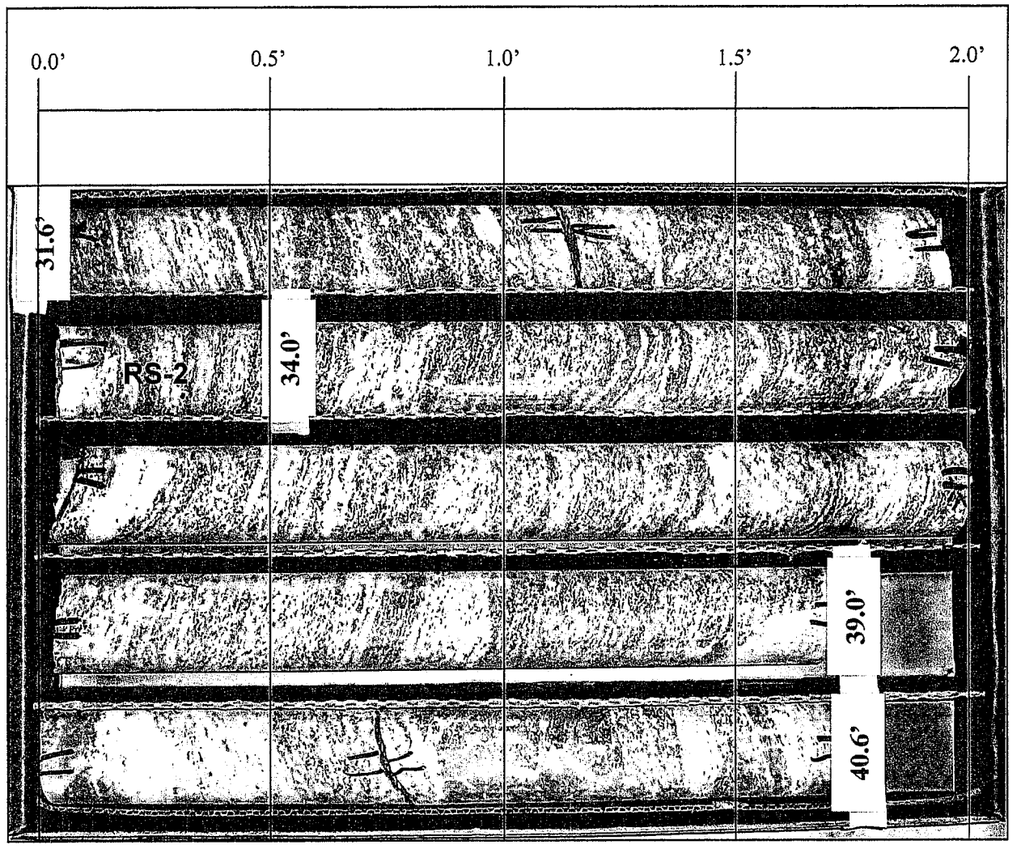
ELEV. (FT)	DEPTH (FT)	DRILL RATE MIN/FT	RUN (FT)	REC FT %	RQD FT %	SAMP #	FIELD CLASSIFICATION AND REMARKS
880.8	21.0	3:00					21.0-23.5 CR: GRAY, WHITE AND BLACK, V. SLI. TO MOD. SEV. WEATHERED, HARD TO MOD. HARD, V. CLOSE TO MOD. CLOSELY FRACTURED, HORNBLENDE GNEISS
		1:50		3.0/3.0	1.4/3.0		
		2:00	3.0			RS-1	
				100%	46.7%		
877.8	24.0						STRATA REC = 100% STRATA RQD = 56%
877.8	24.0	1:00					23.5-27.2 RES: BROWN AND WHITE, MED. DENSE TO V. DENSE, SAND (A-2-4) WITH WR LAYERS, MICACEOUS, SAPROLITIC
		1:30		3.8/5.0	0.33/5.0		
		1:00	5.0				
		2:45		76%	6.6%		
872.8	29.0	3:15					27.2-44.0 CR: WHITE AND GRAY, MOD. WEATHERED TO FRESH, MED. HARD TO V. HARD, V. CLOSE TO WIDELY FRACTURED, HORNBLENDE GNEISS
872.8	29.0	3:30					
		5:30		5.0/5.0	5.0/5.0		
		5:00	5.0			RS-2	
		4:00		100%	100%		
867.8	34.0	4:20					
867.8	34.0	4:00					
		4:00		4.9/5.0	4.9/5.0		
		4:30	5.0				
		4:00		98%	98%		
862.8	39.0	4:15					
862.8	39.0	5:00					
		5:00		5.0/5.0	5.0/5.0		
		5:00	5.0				
		4:30		100%	100%		
857.8	44.0	4:30					STRATA REC = 99.4% STRATA RQD = 90.7%

CORING TERMINATED AT 44.0 FT
ELEVATION 857.8 FT

DRILLER: F. COX CORE SIZE: HQ EQUIPMENT: DIEDRICH 50



Boring B1A, Box 1 of 3, 21.0 feet to 31.6 feet.



Boring B1A, Box 2 of 3, 31.6 feet to 40.6 feet.

ROCK CORE PHOTOGRAPHS

BRIDGE NO. 25 OVER SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA COUNTY, NORTH CAROLINA
STATE PROJECT NO: MA12067B

TIERRA
GEOTECHNICAL • MATERIALS ENGINEERING
TIERRA, INC.
2736 ROWLAND RD.
RALEIGH, NC 27615
PHONE (919) 871-0800
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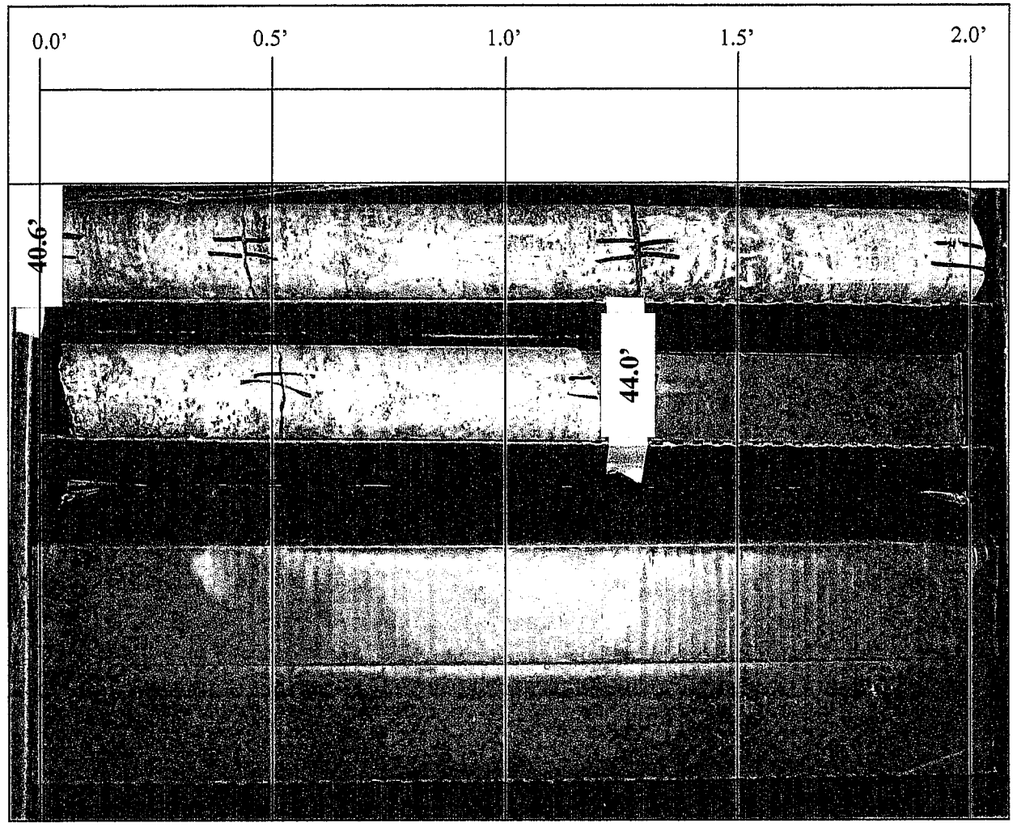

Boring B1A, Box 3 of 3, 40.6 feet to 44.0 feet.

ROCK CORE PHOTOGRAPHS

BRIDGE NO. 25 OVER SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA COUNTY, NORTH CAROLINA
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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. MA12067B	**ID.**	**COUNTY** CATAWBA	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK			**GROUND WATER (ft)**
BORING NO. EB2A	**BORING LOCATION** 21+11	**OFFSET** 19' LT.	**ALIGNMENT** -L-
COLLAR ELEV. 913.1 ft	**NORTHING** 727,239.7	**EASTING** 1,333,770.1	**24 HR.** 12.7
TOTAL DEPTH 35.8 ft	**DRILL MACHINE** DIEDRICH 50	**DRILL METHOD** MUD ROTARY	**HAMMER TYPE** AUTO
DATE STARTED 8-08-05	**COMPLETED** 8-08-05	**SURFACE WATER DEPTH** N/A	

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
913.1					EXISTING GROUND				913.1 0.0
	0.0	1	4	3	7				912.9 ROOTMAT 0.2
910	3.4								RDWY EMB: RED AND BROWN, MED. STIFF TO SOFT, SANDY CLAY (A-7-5)
		2	1	2	3				
	6.4								
		1	2	2	4	SS-6	28.2%		
905	8.4								905.1 8.0
		1	2	2	4				RES: ORANGE AND BROWN, MED. STIFF, SANDY CLAYEY SILT (A-4) SLI. MICACEOUS
900									900.1 13.0
	15.0								RES: MOTTLED, LOOSE TO MED. DENSE, SILTY SAND (A-2-4) SAPROLITIC
		1	3	1	4				
895	18.4								
		3	3	2	5				
890	23.4								
		7	5	8	13	SS-7			
885	28.4								884.2 28.9
		8	49	51/.3	100/.8				WR: BROWN, BLACK AND WHITE, HORNBLENDE GNEISS
									882.1 31.0
880	33.4								WR: BLACK AND WHITE, AMPHIBOLITE
		60/.1			60/.1				
	35.8								877.3 35.8
		60/0			60/0				SPT REFUSAL AT ELEV. 877.3' ON CR: BLACK AND WHITE, AMPHIBOLITE

NCDOT_BORE_VARIABLE DEPTH 05-021 BR 25 - CATAWBA CO.GPJ NCDOT.GDT 8/23/05

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N.C.D.O.T. GEOTECHNICAL UNIT
BORING LOG

SHEET 1 OF 1

PROJECT NO. MA12067B	**ID.**	**COUNTY** CATAWBA	**GEOLOGIST** C. BRUINSMA
SITE DESCRIPTION BRIDGE #25 ON SR 1491 (SECTION HOUSE RD.) OVER LYLE CREEK			**GROUND WATER (ft)**
BORING NO. EB2B	**BORING LOCATION** 20+86	**OFFSET** 23' RT.	**ALIGNMENT** -L-
COLLAR ELEV. 911.8 ft	**NORTHING** 727,226.8	**EASTING** 1,333,817.2	**0 HR.** 9.9
TOTAL DEPTH 46.9 ft	**DRILL MACHINE** DIEDRICH 50	**DRILL METHOD** MUD ROTARY	**24 HR.** 11.4
DATE STARTED 8-08-05	**COMPLETED** 8-09-05	**SURFACE WATER DEPTH** N/A	**HAMMER TYPE** AUTO

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
911.8					EXISTING GROUND				911.8 0.0
	0.0	2	6	4	10	SS-8	26.3%		911.6 ROOTMAT 0.2
910	3.5								RDWY EMB: RED AND BROWN, STIFF TO SOFT, SANDY CLAY (A-7-5) WITH GRAVEL AND SAND
		1	1	1	2				
	6.5								
		3	2	1	3				
905	8.5								903.8 8.0
		1	2	1	3	SS-9	33.4%		ALLUV: RED AND BROWN, SOFT, SANDY CLAYEY SILT (A-4)
900									898.3 13.5
	14.7								RES: BROWN, TAN AND BLACK, LOOSE TO DENSE, SILTY SAND (A-2-4) SAPROLITIC
		5	4	3	7	SS-10			
895	18.5								
		10	10	11	21				
890	23.5								
		6	7	10	17				
885	28.5								
		5	7	18	25				
880	33.5								
		10	18	21	39				
875	38.5								876.3 35.5
		88	12/.1		100/.6				WR: BROWN, TAN AND LT. GREEN, HORNBLENDE GNEISS
870	43.5								
		60/.2			60/.2				
865	46.9								864.9 46.9
		60/0			60/0				SPT REFUSAL AT ELEV. 864.9' ON CR: BROWN, TAN AND LT. GREEN, GNEISS

NCDOT_BORE_VARIABLE DEPTH 05-021 BR 25 - CATAWBA CO.GPJ NCDOT.GDT 10/10/05

TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

SOIL CLASSIFICATION AND GRADATION SHEET

BRIDGE #25 ON SR 1491 OVER LYLE CREEK
NCMA Project No: MA12067B

CATAWBA COUNTY

TIERRA, INC. PROJECT NO: 6211-05-021

BORING #		SAMPLE #	NATURAL MOISTURE CONTENT	TOTAL SAMPLE PERCENT PASSING			ATTERBERG LIMIT		
AASHTO Classification									
STATION #	OFFSET (FEET)	DEPTH (FEET)		#10	#40	#200	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
EB1A		SS-1	26.0%	98	80	56	31	19	12
A-6									
20+14	14 LT	8.6-10.1							
EB1A		SS-2	27.1%	100	90	39	28	21	7
A-4									
20+14	14 LT	13.6-15.1							
EB1B		SS-3	N/A	100	69	12	NP	NP	NP
A-2-4									
19+92	17 RT	13.7-15.2							
EB1B		SS-4	N/A	99	65	19	NP	NP	NP
A-2-4									
19+92	17 RT	23.0-24.5							
B1A		SS-5	N/A	96	70	17	NP	NP	NP
A-2-4									
20+43	10 LT	7.5-9.0							
EB2A		SS-6	28.2%	98	77	53	46	34	12
A-7-5									
21+11	19 LT	6.4-7.9							
EB2A		SS-7	N/A	98	70	20	NP	NP	NP
A-2-4									
21+11	19 LT	23.4-24.9							
EB2B		SS-8	26.3%	83	70	48	46	35	11
A-7-5									
20+86	23 RT	0.0-1.5							
EB2B		SS-9	33.4%	97	83	44	29	22	7
A-4									
20+86	23 RT	8.5-10.0							
EB2B		SS-10	N/A	100	74	23	NP	NP	NP
A-2-4									
20+86	23 RT	14.7-16.2							

TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

SOIL CLASSIFICATION AND GRADATION SHEET

BRIDGE #25 ON SR 1491 OVER LYLE CREEK
NCMA Project No: MA12067B

CATAWBA COUNTY

TIERRA, INC. PROJECT NO: 6211-05-021

BORING #		SAMPLE #	NATURAL MOISTURE CONTENT	TOTAL SAMPLE PERCENT PASSING			ATTERBERG LIMIT		
AASHTO Classification									
STATION #	OFFSET (FEET)	DEPTH (FEET)		#10	#40	#200	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
CHANNEL		S-1	N/A	85	58	7	NP	NP	NP
A-3									
		0.0-1.0							
BANK		S-2	N/A	100	90	17	NP	NP	NP
A-2-4									
		0.0-1.0							

LABORATORY SUMMARY SHEET FOR ROCK CORE SAMPLES
Bridge No. #25 on SR 1491 Over Lyle Creek
Catawba County, North Carolina
MA 12067 B
TIERRA No: 6211-05-021

Boring #	Sample #	Depth (ft)	Average Diameter (in)	Average Length (in)	L/D	Total Volume (ft)3	Total Core Weight (lb)	Core Moisture Content (%)	Core Dry Weight (lb)	Unit Weight (pcf)	Rate of Stress Increase (lbs/min)	Max Unconfined Compression (psi)	Remarks
B1A	RS - 1	21.6 - 22.4	2.480	4.962	2.00	0.0139	2.3437	0.12	2.3409	168.8	5000	7763	
B1A	RS - 2	33.5 - 34.0	2.481	4.974	2.00	0.0139	2.4828	0.02	2.4823	178.5	5000	14273	

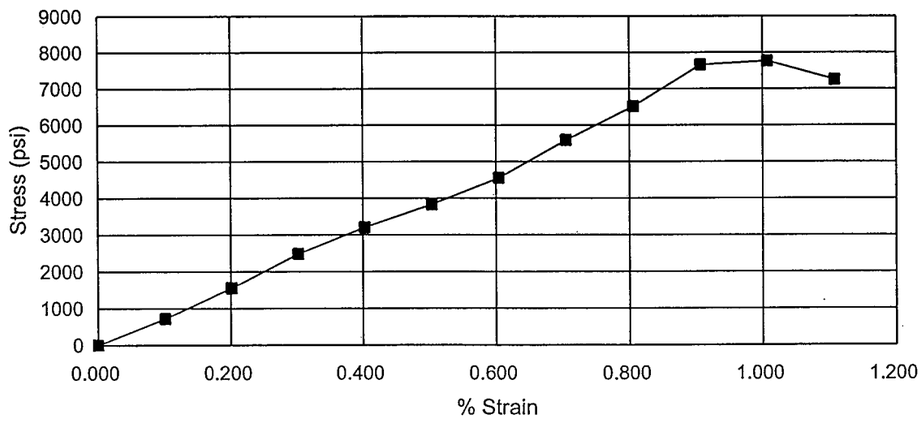
ROCK CORE UNIAXIAL COMPRESSIVE STRENGTH TEST

Job No.: 6211-05-021 Job Name: Bridge 25 on SR 1491 Over Lyle Creek Catawba County, NC

Project No. MA 12067 B
Date: 8/23/2005 Sample No.: RS - 1
Boring No.: B1A Depth (ft): 21.6 - 22.4
Description: Gray, white & black very slightly to moderately severely weathered, hard to moderately hard, very closely to moderatelty closely fractured gneiss
Length (in.): 4.962
Diameter (in.): 2.480
Area (sq. in.): 4.831

Compressive Strength (psi): 7763

Deflection (in.)	Strain (%)	Corrected Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0.0	
0.005	0.101	3500	724.6	719,054
0.010	0.202	7500	1552.6	770,415
0.015	0.302	12000	2484.2	821,776
0.020	0.403	15500	3208.8	796,096
0.025	0.504	18500	3829.8	760,143
0.030	0.605	22000	4554.4	753,295
0.035	0.705	27000	5589.5	792,427
0.040	0.806	31500	6521.0	808,936
0.045	0.907	37000	7659.6	844,603
0.050	1.008	37500	7763.2	770,415
0.055	1.108	35000	7245.6	653,686
0.060	1.209	0	0.0	



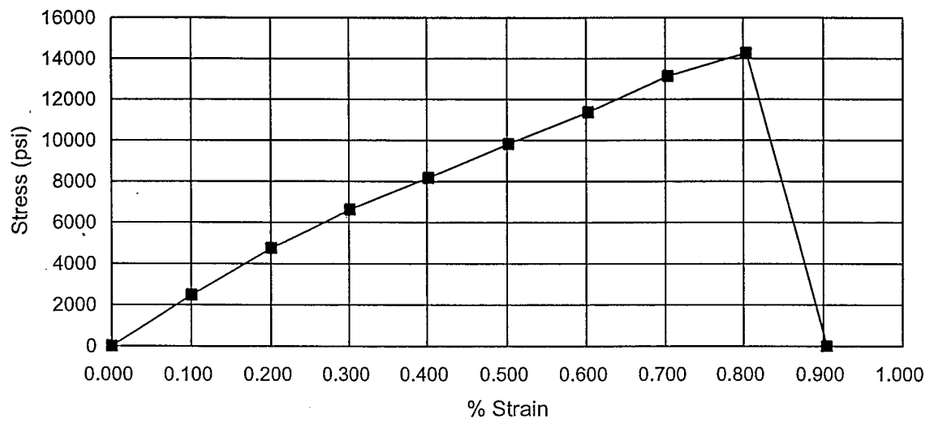
ROCK CORE UNIAXIAL COMPRESSIVE STRENGTH TEST

Job No.: 6211-05-021 Job Name: Bridge 25 on SR 1491 Over Lyle Creek Catawba County, NC

Project No. MA 12067 B
Date: 8/23/2005 Sample No.: RS - 2
Boring No.: B1A Depth (ft): 33.5 - 34.0
Description: White & gray moderately weathered to fresh, medium hard to very hard, very closely to widely fractured gneiss
Length (in.): 4.974
Diameter (in.): 2.481
Area (sq. in.): 4.834

Compressive Strength (psi): 14273

Deflection (in.)	Strain (%)	Corrected Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0.0	
0.005	0.101	12000	2482.2	2,469,299
0.010	0.201	23000	4757.6	2,366,411
0.015	0.302	32000	6619.2	2,194,932
0.020	0.402	39500	8170.6	2,032,027
0.025	0.503	47500	9825.4	1,954,861
0.030	0.603	55000	11376.8	1,886,270
0.035	0.704	63500	13135.0	1,866,672
0.040	0.804	69000	14272.7	1,774,808
0.045	0.905	0	0.0	0



GEOTECHNICAL UNIT FIELD SCOUR REPORT

PROJECT: MA120067B ID: _____ COUNTY: CATAWBA

DESCRIPTION(1): BRIDGE #25 ON SR 1491 OVER LYLE CREEK

INFORMATION ON EXISTING BRIDGES Information obtained from: _X_ field inspection
___ microfilm(Reel: ____Pos: __)
_X_ other HYDRO

COUNTY BRIDGE NO. 25 BRIDGE LENGTH 75 NO. BENTS IN: CHANNEL 2 FLOOD PLAIN 2

FOUNDATION TYPE: DRIVEN WOOD PILES, OLD CONCRETE ABUTMENTS STILL IN PLACE

EVIDENCE OF SCOUR(2):

ABUTMENTS OR END BENT SLOPES: ALONG BOTH BANKS, CHANNEL SCOURED DOWN ~3+ FEET

INTERIOR BENTS: MINIMAL

CHANNEL BED: SCOURED DOWN RELATIVELY RECENTLY UP TO 4 FEET

CHANNEL BANKS: SCOURED UP AND DOWNSTREAM, VERY LITTLE STABILIZING GROWTH

EXISTING SCOUR PROTECTION:

TYPE(3): NONE

EXTENT(4): N/A

EFFECTIVENESS(5): N/A

OBSTRUCTIONS(6) (DAMS,DEBRIS,ETC.): NONE

DESIGN INFORMATION

CHANNEL BED MATERIAL(7) (SAMPLE RESULTS ATTACHED): SILTY SAND WITH GRAVEL INTERSTITIAL SAND

CHANNEL BANK MATERIAL(8) (SAMPLE RESULTS ATTACHED): SILTY SAND

CHANNEL BANK COVER(9): GRASSES, TREES AND SHRUBS

FLOOD PLAIN WIDTH(10): 200 FEET

FLOOD PLAIN COVER(11): GRASSES, TREES AND SHRUBS

DESIGN INFORMATION CONT.

STREAM IS _x_ DEGRADING _____ AGGRADING (12)

OTHER OBSERVATIONS AND COMMENTS: STREAM IS VERY FLASHY AND ACTIVE. NEARBY LANDOWNER STATED THAT STREAM CAN RISE 10 FEET WITH TORRENTIAL RAINS.

CHANNEL MIGRATION TENDENCY (13): TO THE NORTH

REPORTED BY: Christina Bruinsma PE DATE: 8/11/2005
TIERRA, INC

GEOTECHNICALLY ADJUSTED SCOUR ELEVATION (14): _____

REPORTED BY: _____ DATE: _____
NCDOT GEOTECHNICAL UNIT

INSTRUCTIONS

(1) GIVE THE DESCRIPTION OF THE SPECIFIC SITE GIVING ROUTE NUMBER AND BODY OF WATER CROSSED.
(2) NOTE ANY EVIDENCE OF SCOUR AT THE EXISTING END BENTS OR ABUTMENTS (UNDERMINING, SLOUGHING, SCOUR LOCATIONS, DEGRADATIONS, ETC.)
(3) NOTE ANY EXISTING SCOUR PROTECTION (RIP RAP, ETC.)
(4) DESCRIBE THE EXTENT OF ANY EXISTING SCOUR PROTECTION.
(5) DESCRIBE WHETHER OR NOT THE SCOUR PROTECTION APPEARS TO BE WORKING.
(6) NOTE ANY DAMS, FALLEN TREES, DEBRIS AT BENTS, ETC.
(7) DESCRIBE THE CHANNEL BED MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.
(8) DESCRIBE THE CHANNEL BANK MATERIAL: A SAMPLE SHOULD BE TAKEN FOR GRAIN SIZE DISTRIBUTION, ATTACH LAB RESULTS.

(9) DESCRIBE THE BANK COVERING (GRASS, TREES, RIP RAP, NONE, ETC.
(10) GIVE THE APPROXIMATE FLOOD PLAIN WIDTH (ESTIMATE).
(11) DESCRIBE THE FLOOD PLAIN COVERING (GRASS, TREES, CROPS, ETC.)
(12) CHECK THE APPROPRIATE SPACE AS TO WHETHER THE STREAM IS DEGRADING OR AGGRADING
(13) DESCRIBE THE POTENTIAL OF THE BODY OF WATER TO MIGRATE LATERALLY DURING THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS).
(14) GIVE THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION EXPECTED OVER THE LIFE OF THE BRIDGE (APPROXIMATELY 100 YEARS). THIS CAN BE GIVEN AS AN ELEVATION RANGE ACROSS THE SITE, OR ON A BENT BY BENT BASIS WHERE VARIATIONS EXIST. DISCUSS RELATIONSHIP BETWEEN THE HYDRAULICS THEORETICAL SCOUR AND THE GEOTECHNICALLY ADJUSTED SCOUR ELEVATION. THE GEOTECHNICALLY ADJUSTED SCOUR ELEVEVATION IS BASED ON THE ERODABILITY OF MATERIALS WITH CONSIDERATION FOR JOINTING, FOLIATION, BEDDING ORIENTATION AND FREQUENCY; CORE RECOVERY PERCENTAGE; PERCENTAGE RQD; DIFFERENTIAL WEATHERING, SHEAR STRENGTH; OBSERVATIONS AT EXISTING STRUCTURES; OTHER TESTS DEEMED APPROPRIATE; AND OVERALL GEOLOGIC CONDITIONS AT THE SITE.

PROJECT #: MA120067B

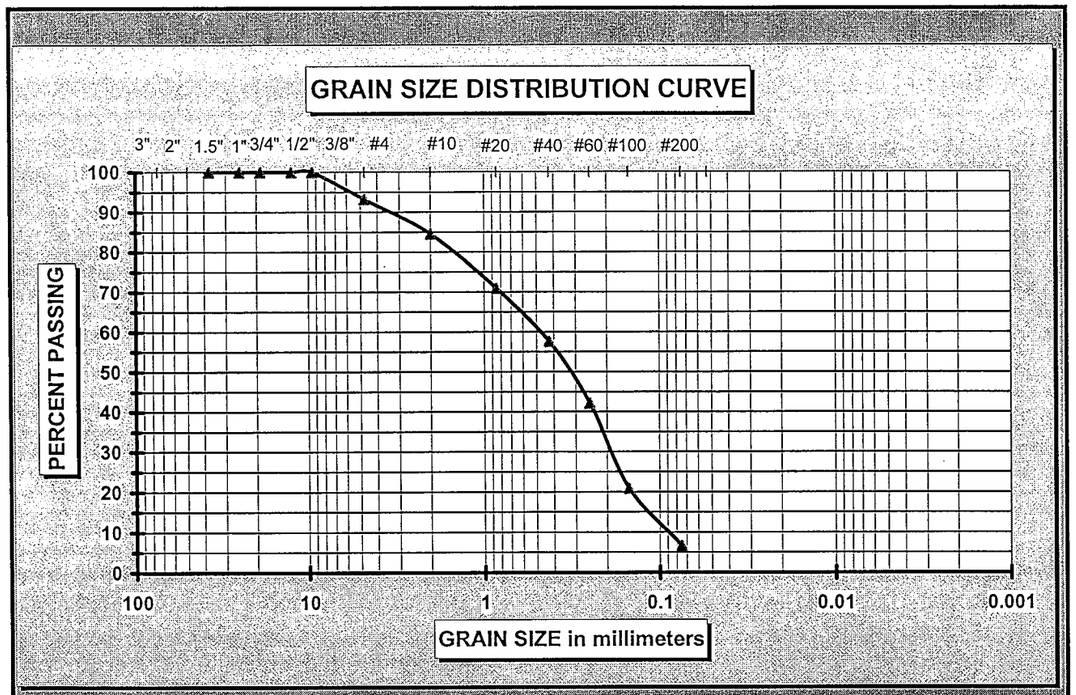
COUNTY: CATAWBA

DESCRIPTION: BRIDGE #25 ON SR 1491 OVER LYLE CREEK

	CHANNEL BED MATERIAL			CHANNEL BANK MATERIAL			
SAMPLE #	S-1			S-2			
RETAINED #4	6.8			0.0			
PASSING #10	84.6			100.0			
PASSING #40	57.7			99.0			
PASSING #200	6.7			16.6			
SAND	86.5			83.4			
SILT/CLAY	6.7			16.6			
LL	NP			NP			
PL	NP			NP			
AASHTO	A-3			A-2-4			
STATION	20+66			20+70			
OFFSET	CL			CL			
DEPTH	0.0-1.0			0.0-1.0			

TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

BRIDGE #25 ON SR 1491 OVER LYLE CREEK
CATAWBA COUNTY
NCMA Project No: MA12067B



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #40	Cu = D60 / D10
			Fine Sand	< #40 and > #200	Cc = (D30)^2 / (D10 x D60)

BORING #: CHANNEL SAMPLE #: S-1 DEPTH: 0.0-1.0

BROWN SLIGHT SLITY SAND (A-3)

% PASSING #200 SIEVE: 7%

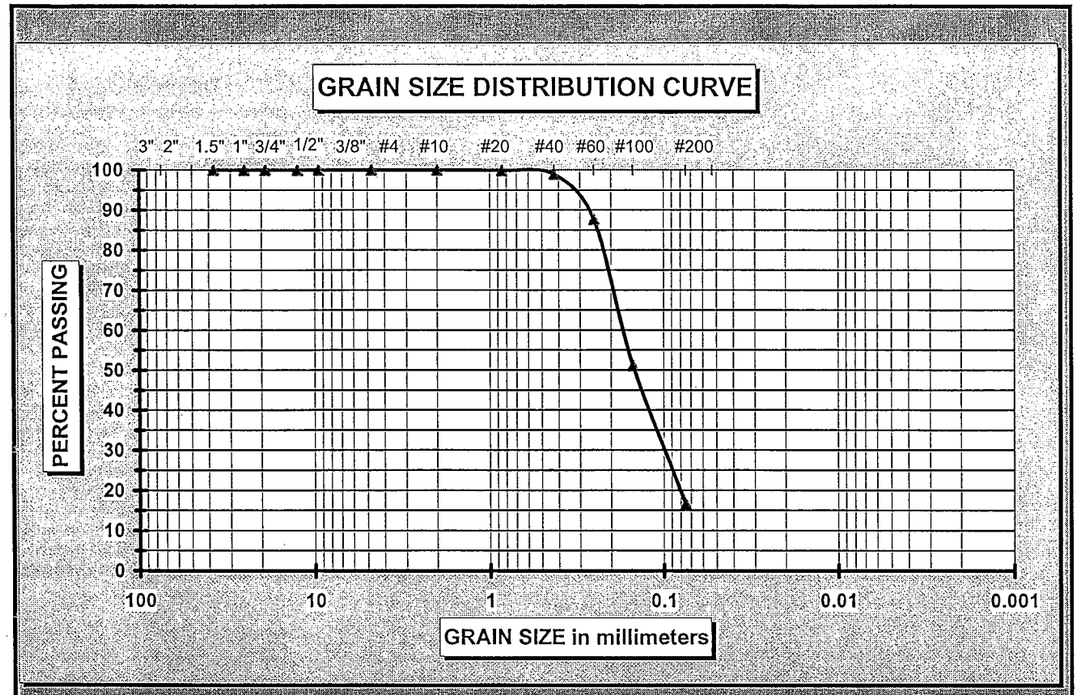
NATURAL MOISTURE CONTENT = N/A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTIC INDEX	NP

TIERRA, INC. PROJECT #: 6211-05-021

TIERRA, INC. 2736 ROWLAND RD. RALEIGH, NORTH CAROLINA 27615

BRIDGE #25 ON SR 1491 OVER LYLE CREEK
CATAWBA COUNTY
NCMA Project No: MA12067B



AASHTO M-145 Classification of Soil for Engineering Purposes					
Gravel	< 3" and > #10		Coarse Sand	< #10 and > #40	Cu = D60 / D10
			Fine Sand	< #40 and > #200	Cc = (D30)^2 / (D10 x D60)

BORING #: BANK SAMPLE #: S-2 DEPTH: 0.0-1.0

BROWN SILTY SAND (A-2-4)

% PASSING #200 SIEVE: 17%

NATURAL MOISTURE CONTENT = N/A

ATTERBERG LIMIT (- #40 Material)	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTIC INDEX	NP

TIERRA, INC. PROJECT #: 6211-05-021

OVERVIEW OF CATAWBA BRIDGE #25, LOOKING SOUTHEAST

PROFILE OF CATAWBA BRIDGE #25, LOOKING UPSTATION

SITE PHOTOS

BRIDGE NO. 25 ON SR 1491
(SECTION HOUSE RD.) OVER LYLE CREEK
CATAWBA CO., NORTH CAROLINA
STATE PROJECT: MA12067B

TIERRA
GEOTECHNICAL • MATERIALS
ENGINEERING

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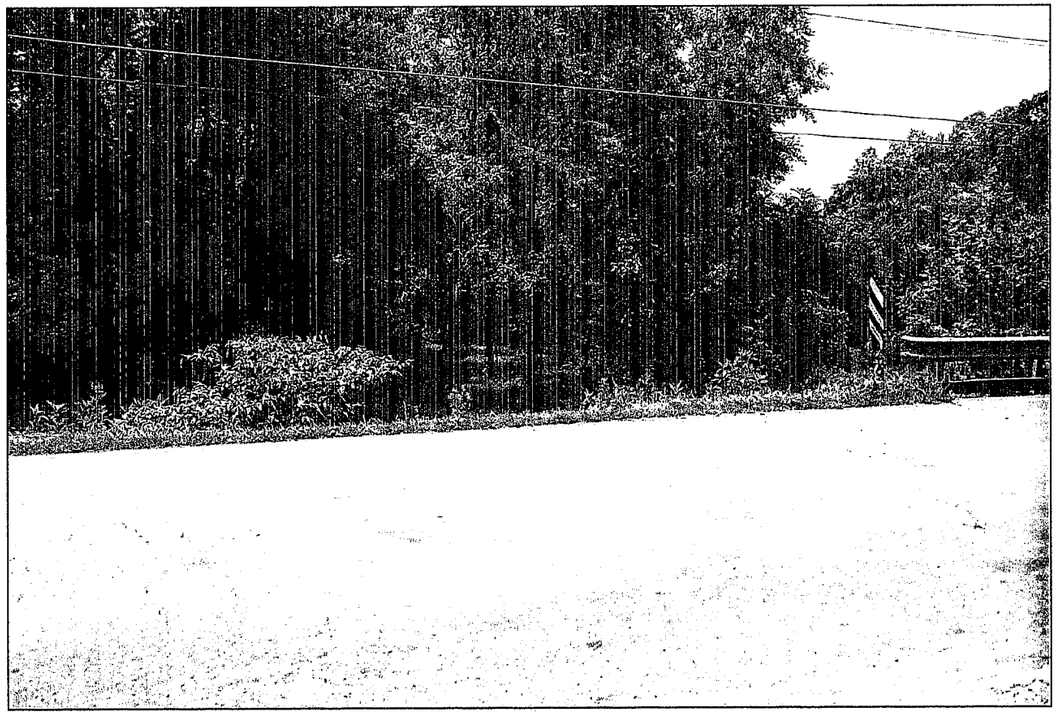

END BENT 1, LOOKING FROM EB1B TO EB1A

END BENT 2, LOOKING FROM EB2B TO EB2A

SITE PHOTOS

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